Consolidated Program for Research and Development for Welding of High Strength Steel Pipelines, #277 & 278

PUBLIC PAGE

QUARTERLY REPORT

Project WP#278: Development of Optimized Welding Solutions for X100 Line Pipe Steel

For Period Ending: February 28, 2010

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Background

To meet the increasing demand for energy in North America, oil and gas reserves in more remote and challenging regions are being developed where large volumes of natural gas will be transported by new long distance, high pressure transmission pipelines. Advanced pipeline designs utilizing high strength line pipe is a key element in meeting these increasing energy demands. A significant amount of laboratory research has been conducted on the development of X100 line pipe and associated welding technology; including, a few recent demonstration projects of limited size and scope. Accordingly, there are few welding process options proven for X100 and the knowledge resides within a small number of companies. The objectives of the proposed work are to establish the range of viable welding options for X100 line pipe, define essential variables to provide for welding process control that ensures reliable and consistent mechanical performance, validate the new essential variables methodology for relevant field welding conditions, and verify weld metal performance through a combination of small and large scale tests. Full implementation will be achieved through changes to applicable codes and standards.

Progress in the Quarter

The project activities undertaken through the tenth quarter focused on (1) State of the Art Review; (2) Identification of Essential Variables; and (3) Fundamental Understanding of Welding Processes and Essential Variables. The team is finalizing the work to develop the gap analysis for the welding of high strength steel pipelines. Joint web-conferences with Project 277 have been held once every two weeks.

The team has made significant progress in characterizing the baseline X100 welds from the first and second round of welding trials.

The team is also nearing completion of the mechanical and metallurgical tests on the single-torch girth welds produced in June 2008. The team has verified the overall consistency of these welds through mechanical property tests and metallography. They have also completed detailed microstructural studies on the welds.

The researchers originally completed a second set of girth welds, including single- and dual-torch welds in 1G and 5G positions in January 2009. The small-scale and curve wide plate testing is well underway for these welds along with detailed assessment of their microstructure and properties.

The project team has completed four rounds of simulations for the virtual experiment. The results from these simulations have been analyzed and summarized based on which primary and

secondary welding variables have been identified. The team is working on further validating these predictions based on actual plate welding experiments.

The team is conducting further HAZ simulation experiments on the previously selected X100 and selected lower strength X80 pipe steels and has begun the physical simulation tests on the five experimental welds produced with a range of WM chemistries that are based on nominal Mo, Ni-Mo, and Ni-Cr-Mo alloy systems.